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FISHERY RESOURCE ASSESSMENT AND HARVEST
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APPLICATION OF ERTS-1 FOR
FISHERY RESOURCE ASSESSMENT AND HARVEST

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APPLICATION OF ERTS-1
FOR FISHERY RESOURCE ASSESSMENT AND HARVEST

by

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The status of a combined Federal Government/private industry study to establish the feasibility of utilizing ERTS-1 imagery to assess, monitor, and predict the distribution and abundance of living marine resources is reported. The 15-month study, initiated in July 1972, emphasizes acquisition of data from various platforms to:

- Determine the effectiveness and reliability of ERTS-1 and high level aircraft sensor data to provide fisheries significant oceanographic data about coastal waters.
- Demonstrate the feasibility of using remotely-sensed oceanographic information to assess, monitor and predict adult menhaden in the Mississippi Sound and adjacent waters.
- Ascertain the usefulness of remotely-acquired oceanographic environmental and resource information for improving the harvest and management of the menhaden resource.

The test area is an 8,685 square kilometer rectangle in the north central Gulf of Mexico (Figure 1). The area encompasses all of the Mississippi Sound and the lower portion of Mobile Bay. It extends offshore to approximately the 10-fathom curve or to a distance of approximately 50 kilometers off shore.

Data collected by ERTS and ITOS satellites, and aircraft, are being used to generate color, clarity, temperature, and salinity information. This information and supporting surface measurements are being analyzed for possible relationships between the occurrence of adult menhaden and these parameters.

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Conventional sampling techniques have not adequately defined the synoptic distribution of surface parameters, horizontal movement with passage of time, or whether the parameter duration is short-term or long-term. It is hoped that the imagery and data acquired by satellite and aircraft sensors will significantly supplement assessment and monitoring of surface oceanographic parameters.

Remotely sensed data are being converted into oceanographic data, which in turn are being related to the distribution and abundance of the menhaden. This information can then be applied to the management and utilization of that resource.

Measurements consist of conventional oceanographic data and fish resource information taken within the test site at the time of the ERTS-1 overpass. Samples obtained by fishing industry vessels complement the information taken by weekly overflights of contract aircraft, and they provide a record of changes in environmental and fisheries characteristics of the Mississippi Sound area. Four intensive sampling periods are being carried out. The sampling periods occur concurrently with ERTS overpasses. During each period approximately 15 vessels occupy up to 85 surface stations distributed along predetermined aerial survey lines throughout the test site. Surface oceanographic data are collected at each station.

Biological and fishing information is acquired from commercial fishing vessels and spotter aircraft. Additional biological information is being acquired by aerial photography and low-light-level television surveys of the test area.

Four separate types of results are expected from this investigation:

- Environmental data to provide a synoptic view of the test area conditions.
- Fishery data to provide information on the availability and distribution of adult menhaden in the test area.
- Correlation of these data to provide an insight into the relationship between selected environmental parameters and the fish resource.
- Comparison of the environmental and resource relationship to provide information about the utilization of remotely-sensed data in the assessment, location, and harvesting of adult menhaden.

Primary program coordinating responsibility lies with NOAA, National Marine Fisheries Service's Fisheries Engineering Laboratory at the Mississippi Test Facility (MTF) and NASA's Earth Resources Laboratory

(ERL) at MTF. Industries, through the National Fish Meal and Oil Association (NFMOA) and Earth Satellite Corporation (EarthSat), are full contributing partners in the program (Figure 2).

Data Acquisition Operations

The program was initiated on June 25, 1972. Major field operations will continue until the end of October and may be continued into November if necessary. A limited field operation is scheduled for two successive passes in January and early February. There are four elements in the data acquisition operation. These are:

- Oceanographic data from NASA and contractual aircraft and chartered surface vessels.
- Biological data acquired from commercial fishing boats and spotter aircraft.
- Biological data from aerial photography.
- Biological data from low-light-level image intensifier surveys run the night before and the night after the test mission.

Fourteen missions have been successfully conducted through September. A "mini" main day mission was run on July 6, 1972. This dress rehearsal provided the experience and operational knowledge necessary for effective operation during the first ERTS-1 overpass. Main day missions were run on August 7 and 25 and September 28. ERTS-1 imagery with 50-percent or less cloud cover should be available for August 6, 7, 24, 25, September 11 and 12. At the time of the September 29 and 30 ERTS-1 overflight there was over 60-percent cloud cover over the test area on both days. Ten weekly secondary missions have been conducted to acquire data for comparison of physical and biological activities in the test area between the ERTS-1 overpasses. In each of the missions, operational problems were encountered such as unsuitable weather, aircraft or instrument breakdowns, etc. However, these were anticipated in the project design and by substituting one data source for another, useful data packages were obtained on each mission.

Data Processing Operations

Computer programs have been written and tested to input all data from the acquisition system into a common ERTS-1 data file. The ERTS-1 data file works in conjunction with the Environmental Information and Retrieval System (ENVIR) developed by the Gulf Universities Research Consortium (GURC) with support by NASA at Mississippi Test Facility.

The ENVIR system is capable of the following functions: Data file generation, retrieval, editing; and routine statistical analysis functions on preselected data items. In addition, special display programs are in the system to generate the desired product. The ENVIR system is designed to work with the NMFS Atlas display system to provide land mass environmental and biological data plotting and composite plots produced on a Stromberg-Carlson electronic plotter. Ground truth data for the main day and four secondary day missions are in the data file. Biological data from commercial operations, aerial photography, and low-light-level television are presently being keypunched and verified for insertion into the data file. Aircraft and satellite data are being processed and configured where appropriate for entry into the data file.

Analysis of the data is just beginning. The data processing system is generating predefined products for visual comparison and statistical analysis with the available data. Some examples of the data being collected and products generated are:

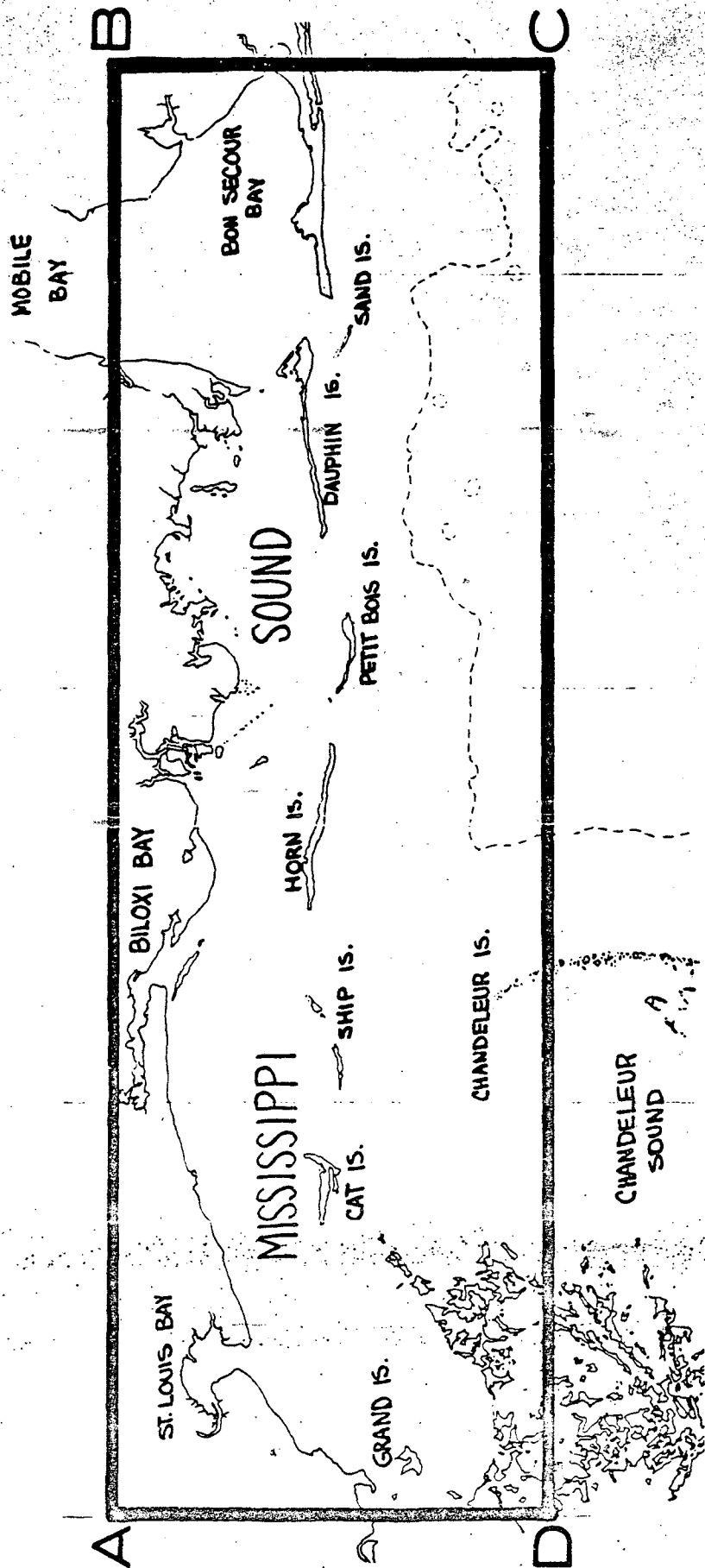
- Sea surface temperature contour plots.
- Sea surface salinity contour plots.
- Aerial photography of fish schools.
- Aerial photography of fishing operations.
- LLLTV imagery of fish schools taken at night.
- Secchi disk visibility contour plots.
- Chlorophyll contour plots.
- ERTS-1 imagery.

Preliminary analysis of August 7 ERTS-1 color composite, which is not the ideal imagery for studying oceanographic phenomena, identifies immediate potential applications of ERTS data. A comparison of a hand-contoured plot of secchi disk readings taken by the surface measurement vessels with the ERTS-1 image indicates that features associated with water clarity are clearly displayed in the imagery, and furthermore, the imagery reveals some of the finer detail which is not apparent from the contour map.

The relationship between the gray shades of the ERTS imagery and the secchi disk readings is being analyzed to establish the specific correlations. Present understanding of the relationship between the

distribution and availability of a resource and the water clarity is based upon classical contour plot data. The ERTS-1 imagery appears to present a new method of acquiring additional data which, when the image is calibrated with the ground truth station data, may result in a mapping of water clarity which is significantly more accurate than present techniques. This in turn should result in a better understanding of the environmental-resource relationship which has been eluding the fisheries community for so many years. The use of satellite data to determine this relationship is much more promising when the temporal dynamics of the ocean surface are considered. Temperature, color, water clarity and possibly salinity data of the ocean surface defined by satellite data can, in the immediate future, open new avenues of understanding about the relationship between the ocean environment and the living marine resource.

The project is on schedule, and the program objectives are valid. The quality of the ERTS-1 data strongly suggests a significantly improved oceanographic data base can be developed using multispectral data to produce maps of surface clarity and possibly color. This improved data base could result in a better understanding of the relationship between the environment and the living marine resource.



AREA
AREA
DIMENSIONS

LINE KM

A-B: 170.3

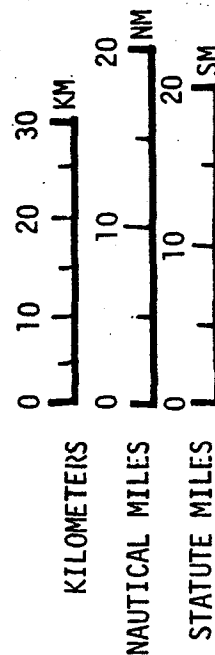
B-C: 51.0

C-D: 170.3

A-D: 51.0

TOTAL AREA: 8,685.3 KM²

SCALE



AREA COORDINATES

LATITUDE (N) LONGITUDE (W)

A. 30° 27' 89° 50'

B. 30° 27' 87° 45'

C. 30° 00' 87° 45'

D. 30° 00' 89° 50'

Figure 1. ERTS-A Experiment Test Site

ORGANIZATIONAL RESPONSIBILITIES

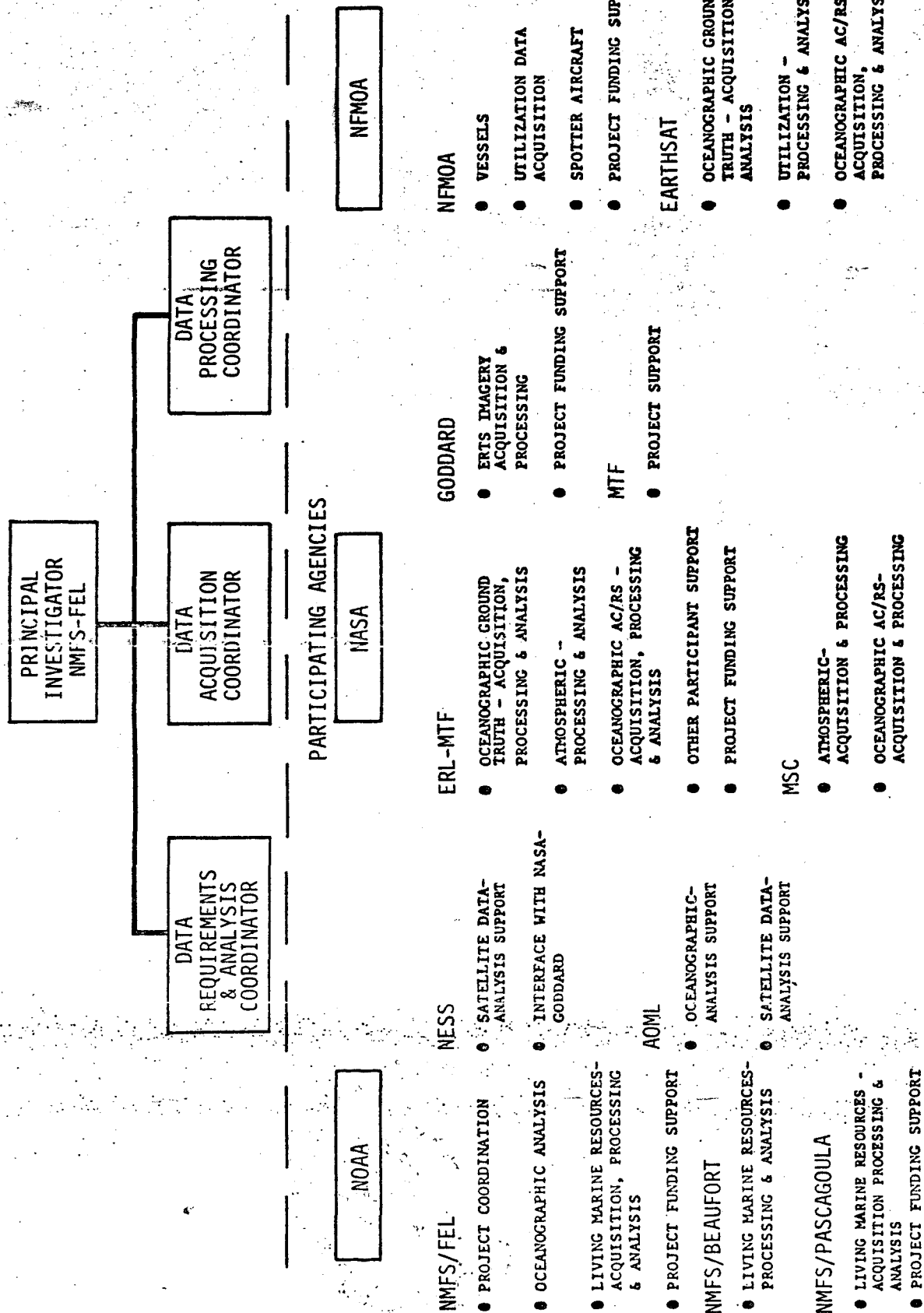


Figure 2. Program Responsibilities